

Claims

- 5 1. A process for connecting at least two substrates (1, 1') by means of bonding after pretreating at least one of the bonding surfaces, characterized in that for the pretreatment a plasma (2) is acting on the bonding surface under atmospheric pressure.
- 10 2. The process according to claim 1, wherein the plasma (2) is generated by corona discharge (8).
3. The process according to claim 1 or 2, wherein the bonding surface (1a) is cleaned by the plasma (2).
- 15 4. The process according to any one of claims 1 to 3, wherein the bonding surface (1a) is chemically activated by the plasma (2).
5. The process according to any one of claims 1 to 4, wherein a layer of the bonding surface (1a) is removed by the plasma (2).
- 20 6. The process according to any one of claims 1 to 5, wherein a layer is grown on the bonding surface (1a) by the plasma (2).
- 25 7. The process according to any one of claims 1 to 5, wherein the substrates (1, 1') are connected directly during bonding.
8. The process according to any one of claims 1 to 5, wherein the substrates (1, 1') are connected via metal layers covering the substrates fully or partly.
- 30 9. The process according to claim 8, wherein the metal layers consist of copper.
10. The process according to any one of claims 1 to 9, wherein the plasma treatment takes place before a wet chemical cleaning of the substrates (1, 1').
- 35 11. The process according to any one of claims 1 to 9, wherein the plasma treatment takes place after a wet chemical cleaning of the substrates (1, 1').

12. The process according to any one of claims 1 to 11, wherein the plasma treatment takes place as the last step before bonding.
13. The process according to any one of claims 10 to 12, wherein the plasma treatment and the wet chemical cleaning take place several times.
14. The process according to any one of claims 1 to 13, wherein the plasma (2) is generated by using O₂ gas or O₃ gas or inert gases.
15. The process according to claim 14, wherein the plasma (2) is generated by using N₂ gas.
16. The process according to any one of claims 1 to 15, wherein CO₂, NH₃, forming gas or HCl or a mixture of said gases is used as the process gas.
17. The process according to any one of claims 1 to 16, wherein the plasma (2) is passed across the bonding surface (1a) of the substrate (1, 1').
18. The process according to any one of claims 1 to 16, wherein the bonding surface (1a) of the substrate (1, 1') is moved through the plasma (2).
19. The process according to any one of claims 1 to 16, wherein the plasma (2) and the bonding surface (1a) of the substrate (1, 1') are moved relative to each other.
20. The process according to any one of claims 17 to 19, wherein the plasma (2) is passed across the bonding surface (1a) in only one scan.
21. The process according to any one of claims 1 to 20, wherein the plasma (2) acts simultaneously on the bonding surfaces (1a) of a plurality of substrates (1, 1').
22. The process according to any one of claims 1 to 21 for the pretreatment in the bonding of semiconductor substrates or in SOI bonding.
23. A device for pretreating the surfaces (bonding surfaces 1a) of substrates (1, 1') before bonding comprising a device for generating a plasma (2) by corona discharge (8) between a high voltage electrode (3; 31, 32) and a counter electrode and further comprising a support (4, 4') for arranging at least one substrate (1, 1') in the plasma.

24. The device according to claims 23, wherein the support (4, 4') is configured as a counter electrode.
- 5 25. A device for pretreating the surfaces (bonding surfaces 1a) of substrates (1, 1') before bonding comprising a means for generating a plasma (2) by corona discharge (8) with a high voltage electrode (3; 31, 32) and comprising a support (4, 4'), wherein at least one substrate (1, 1') is arranged on the support (4, 4') in the plasma.
- 10 26. The device according to claim 25, wherein the substrate (1, 1') is arranged on the support (4, 4') in an electrically insulated manner.
27. The device according to any one of claims 23 to 26, wherein the high voltage electrode (3) and the support (4, 4') can be moved relative to each other.
- 15 28. The device according to claim 27, wherein the high voltage electrode (3) and the support (4, 4') can be moved relative to each other in the horizontal (A) and vertical (B) directions.
- 20 29. The device according to any one of claims 23 to 28, wherein the distance (d) between the high voltage electrode (3) and the surface (1a) of the substrate (1) is 0.2 to 3 mm, preferably 0.5 to 2 mm.
- 25 30. The device according to any one of claims 23 to 29, wherein the corona discharge takes place at an electrode voltage of 10 to 20 kV and at a frequency of 20 kHz to 14 MHz.
31. The device according to any one of claims 23 to 30 comprising a means for treating substrates having a diameter of up to 300 mm.
- 30 32. The device according to any one of claims 23 to 31, wherein at least two substrates (1, 1') are treated lying in the same plane.
33. The device according to any one of claims 23 to 31, wherein at least two substrates (1, 1') are treated synchronously lying in two parallel planes.
- 35 34. Use of the device according to any one of claims 23 to 33 for pretreating in the bonding of semiconductor substrates.

35. Use of the device according to any one of claims 23 to 33 for pretreating in SOI bonding.
- 5 36. An arrangement for bonding substrates which comprises at least one device according to any one of claims 23 to 33 that is arranged upstream of said arrangement.
37. The arrangement according to claim 36 which comprises at least one device for wet chemical cleaning that is arranged upstream of said arrangement.